Mappaggio e navigazione 3D a raggi zero nell'ablazione delle aritmie sopraventricolari: stato dell'arte

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MD, PhD

Cardiac Arrhythmia Research Centre, Department of Cardiovascular Medicine
Centro Cardiologico Monzino, IRCCS, University of Milan

Two years ago…

- *Is it possible to obtain zero fluoroscopic exposure in SVT arrhytmia ablation?*
  È possibile ottenere un'esposizione fluoroscopica zero nell'ablazione di tachiaritmie sopraventricolari
  M. Casella

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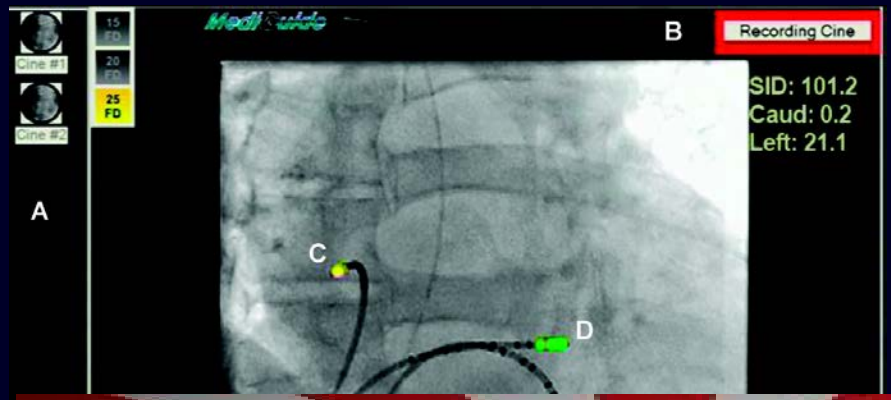
Near future…



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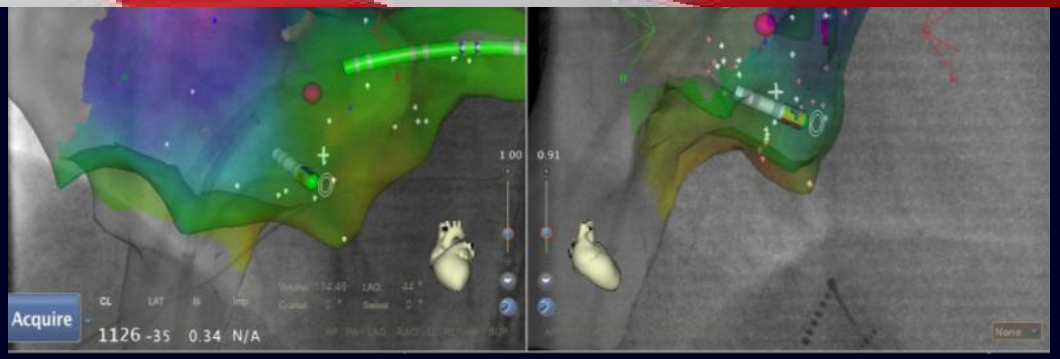
As Low As Reasonably Achievable

MEDIGUIDE



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X-rays have been classified as carcinogens

by the World Health Organization, the Centers for Disease Control and Prevention and the National Institute of Environmental Health Sciences

- **Use of X-ray for medical examinations and tests is the largest artificial source of radiation exposure**

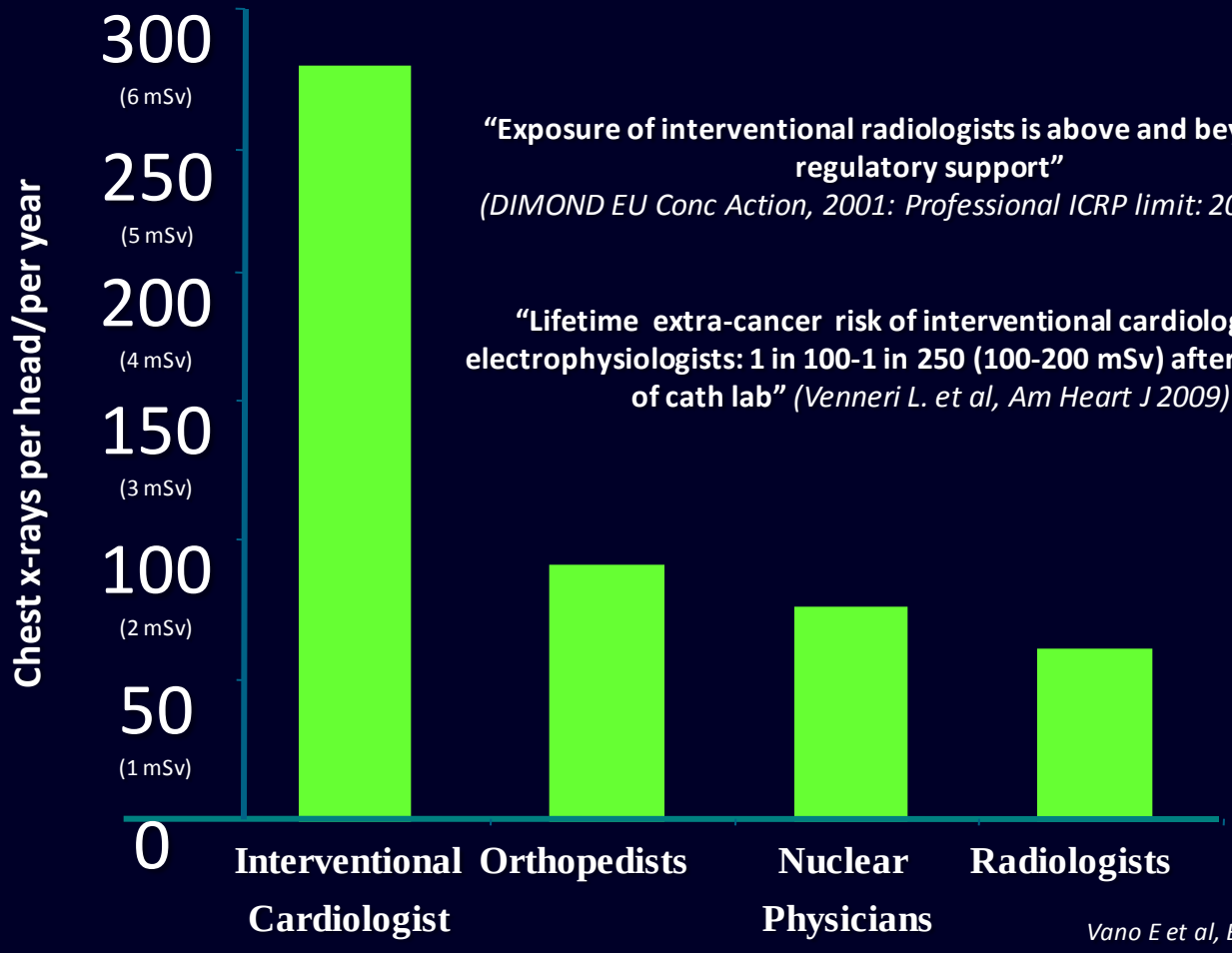
  Cardiovascular interventional procedures are only 12% of all radiological procedures but contribute to 48% of the total collective dose per head in the adult patient

- **In most cases, the cardiologist performs these procedures often without any specific training in radioprotection and often understimating ionizing radiation exposure risk**

"Friendly fire" on interventional cardiologists

"Not infrequently, there is a machismo disregard for radiation protection"

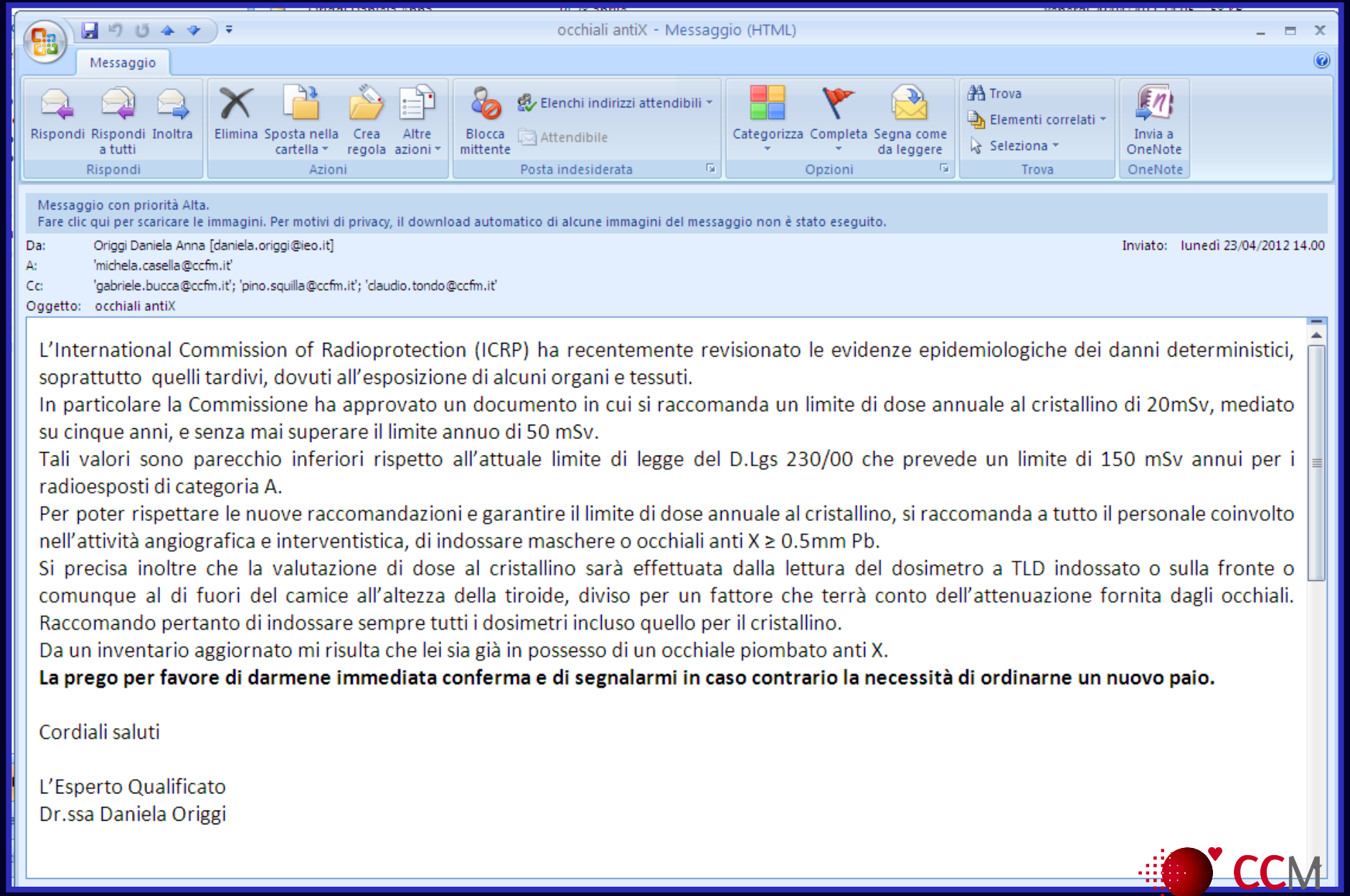
Rita Watson, Sayonara ALARA, Cath Cardiov Diagn, 1997



"Exposure of interventional radiologists is above and beyond every regulatory support"
(DIMOND EU Conc Action, 2001: Professional ICRP limit: 20 mSv/year)

"Lifetime extra-cancer risk of interventional cardiologists and electrophysiologists: 1 in 100-1 in 250 (100-200 mSv) after 11-25 years of cath lab" *(Venneri L. et al, Am Heart J 2009)*

Vano E et al, BJR 1998



The Unbearable Lightness of Imaging

	Mapping System	Pt	Mean Age	Arrhythmia	X-Ray Time (min)	0 X-Ray
Drago *JCE 2002*	CARTO	21	11	Right AP	9.3±7	9/21 (43%)
Papagiannis * *PACE 2006*	NavX	40	12	AVNRT, AVRT	10.4±6	0
Tuzcu * *PACE 2006*	NavX	28	13	AVNRT, AVRT, right-AT	6.2±3	24/28 (86%)
Papez * *JICE 2007*	LocaLisa	113	14	AVNRT, AVRT	17±12	0
Smith * *PACE 2007*	NavX	30	13	AVNRT, AVRT	1.1±0.8	24/30 (80%)
Gist *PACE 2011*	NavX	62	14	AVNRT	0	62/62 (100%)
Kwong * *JICE 2012*	NavX	388	12	AVNRT, AVRT	23.8±11	0

* comparison to conventional ablation performed in pts matched for age and tachycardia mechanism

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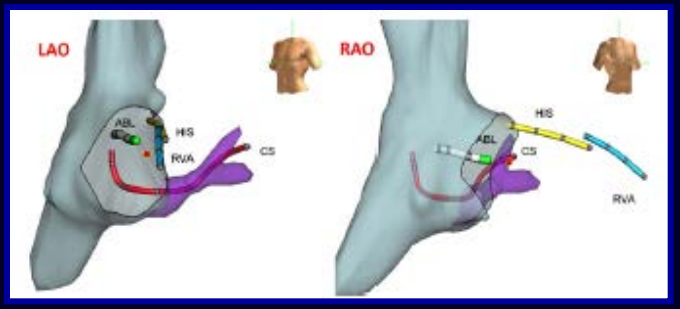
Introduction – Adult Electrophysiology



Safety and feasibility of catheter ablation for atrioventricular nodal re-entrant tachycardia without fluoroscopic guidance

Miguel Álvarez, MD, Luís Tercedor, MD, Isabel Almansa, MD, Natalia Ros, MD,
Ricardo S. Galdeano, MD, Francisco Burillo, MD, Pablo Santiago, MD, Rocío Peñas, RN

From the Ar

BACKGROUND reduce the do ever, they hav tool for electr

OBJECTIVE Th and safety of trant tachycar

METHODS We AVNRT (Group nonfluoroscop were compared who had unde by fluoroscopy rate and the r pared the proc

RESULTS Fift dure was succ (P — .15). O suffered nonse

Cavotricuspid Isthmus Catheter Ablation Without the Use of Fluoroscopy as a First-Line Treatment

MIGUEL ÁLVAREZ, M.D., LUÍS TERCEDOR, M.D., NORBERTO HERRERA, M.D., LUZ MUÑOZ, M.D., RICARDO S. GALDEANO, M.D., FRANCISCA VALVERDE, R.N., ROCÍO PEÑAS, R.N., and RAFAEL MELGARES, M.D.

From the Cardiology Department, Hospital Universitario Virgen de las Nieves, Granada, Spain

Cavotricuspid Isthmus Ablation Without Fluoroscopy. *Introduction and Objectives:* **The use of intracardiac navigation systems has enabled a significant reduction of the radiation dose in the majority of ablation procedures. The purpose of this study is to evaluate the feasibility and safety of cavotricuspid isthmus ablation without the use of fluoroscopy as a first-line treatment.**

Methods and Results: **An observational study without a control group in patients referred for treatment of common atrial flutter. In all of the procedures, Ensite-NavX™ was the only guidance system used to visualize the catheters. One or two diagnostic catheters and a cooled-tip ablation catheter were used in each procedure. Bidirectional cavotricuspid isthmus block was considered to indicate a successful procedure.**

Eighty-three ablation procedures were performed in 80 patients (82.5% men, 61 ± 10 years of age). The procedure was repeated in 3 patients (3.75%) due to flutter recurrence. Success was obtained in 98.8% of the procedures; in 1 patient it was necessary to implant a pacemaker for sinus node dysfunction and 4 patients experienced minor complications. In 75 procedures (90.4%), fluoroscopy was not required. Visualization of the diagnostic catheters was the most common reason for using fluoroscopy. The time required to perform the ablation procedure was similar to that published in other series.

Conclusions: **Cavotricuspid isthmus ablation using a nonfluoroscopic thre-dimensional (3D) navigation system is effective and safe.** *(J Cardiovasc Electrophysiol, Vol. 22, pp. 656-662, June 2011)*

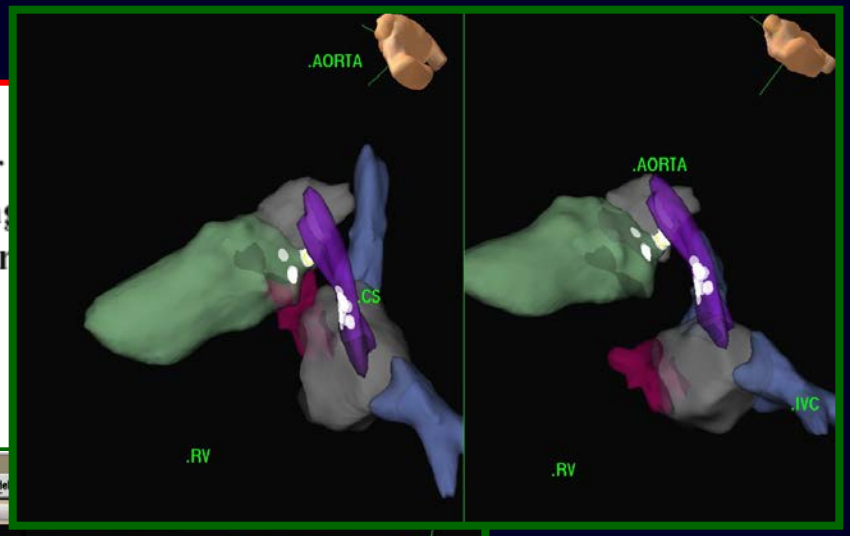
Table 1 EP study and catheter ablation

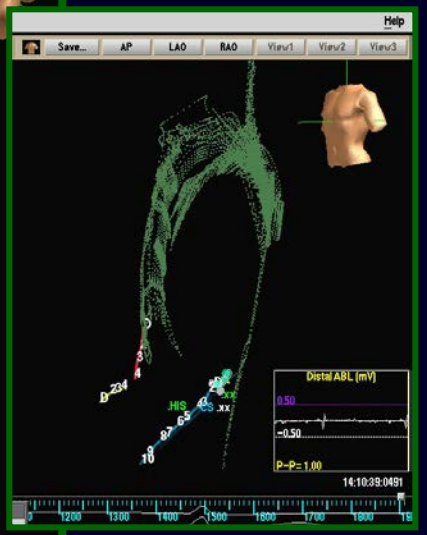
	Group A (no fluoroscopy)	Group B (with fluoroscopy)	*P* value
	50	50	
)	40 (80)	40 (80)	1
	49.5 ± 15	48.8 ± 15	.83
	0	4 (8)	.12
F (%)	50 (100)	50 (100)	1
t treatment			
	13 (26)	7 (14)	.13
rs (%)	18 (36)	31 (62)	<.05
	15 (30)	8 (16)	0.1
	4 (8)	4 (8)	1
AVNRT (%)	46 (92)	50 (100)	.04
use (%)	28 (56)	32 (67)	.28
re (%)	1 (2%)	2 (4%)	.55
	50 (100)	48 (96)	.15
			.78
ion	18 (36)	17 (35.4)	
oes	10 (20)	11 (23)	
thoes	22 (44)	20 (41.6)	
(%)	1 (2)	4 (8)	.48
BBB	1	3	
AVB	0	1	
ation (min)			
	152 ± 35	150 ± 41	.79
	91 ± 29	87 ± 23	.46
	60 ± 26	62 ± 35	.75
RF pulses	5.2 ± 4.2	6 ± 5.4	.5
RF time (min)	4.7 ± 3.7	5.4 ± 5.1	.46

Introduction – Adult Electrophysiology

"Near-zero" fluoroscopic exposure in supraventricular
arrhythmia ablation using the EnSite NavX™ mapping
system: personal experience and review of the literatur

Michela Casella · Gemma Pelargonio · Antonio Dello Russo · Stefania Riva ·
Stefano Bartoletti · Pasquale Santangeli · Antonio Scarà · Tommaso Sanna ·
Riccardo Proietti · Luigi Di Biase · G Joseph Gallinghouse · Maria Lucia Narducci ·
Luigi Sisto · Fulvio Bellocci · Andrea Natale · Claudio Tondo





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Introduction – Adult Electrophysiology

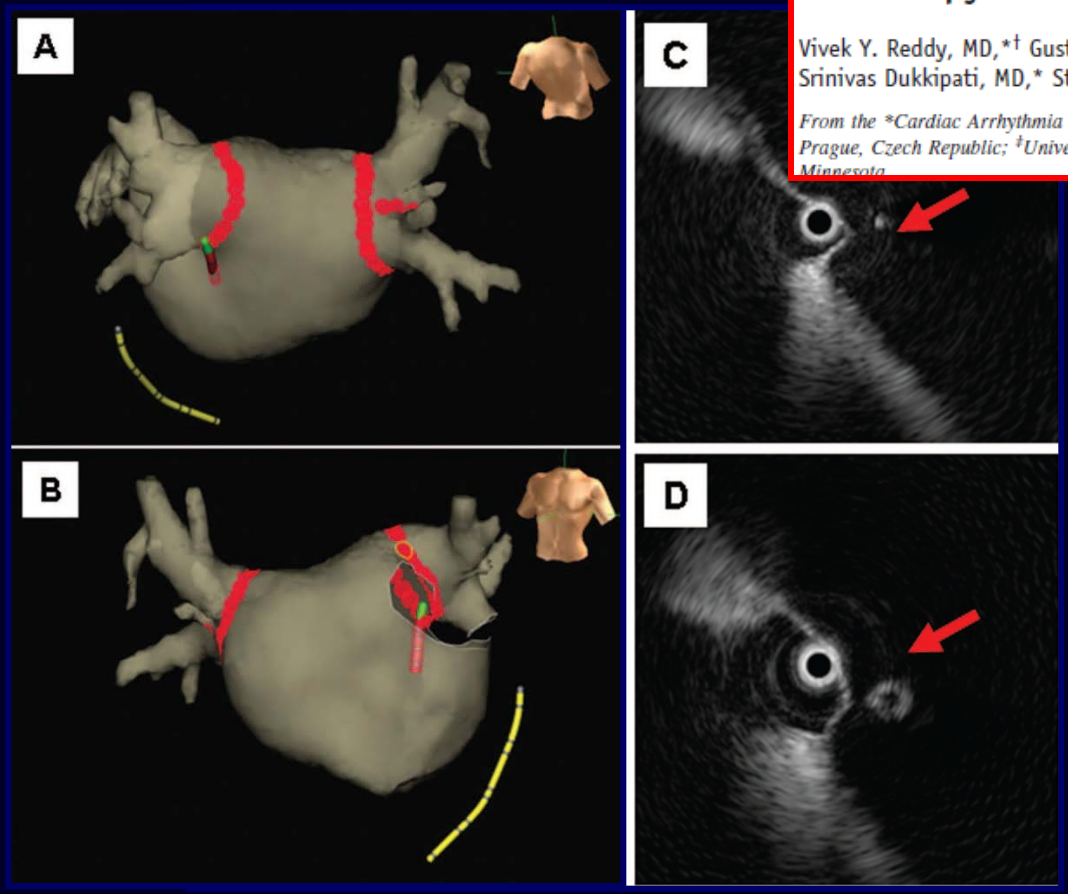
Catheter Ablation of Atrial Fibrillation Without Fluoroscopy Using Intracardiac Echocardiography and Electroanatomic Mapping

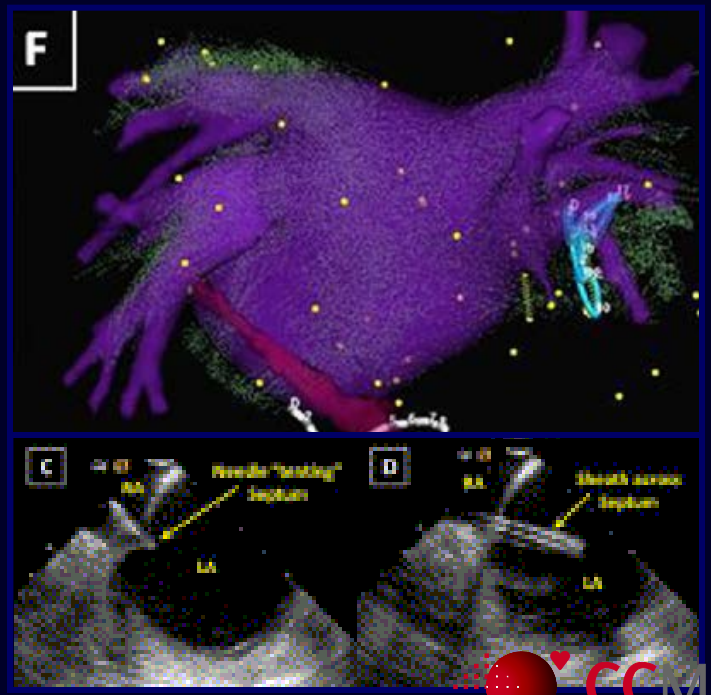
John D. Ferguson, MBChB, MD; Adam Helms, MD; J. Michael Mangrum, MD; Srijoy Mahapatra, MD; Pamela Mason, MD; Ken Bilchick, MD; George McDaniel, David Wiggins, BS; John P. DiMarco, MD, PhD

Catheter ablation of atrial fibrillation without the use of fluoroscopy

Vivek Y. Reddy, MD,*† Gustavo Morales, MD,‡ Humera Ahmed, BA,* Petr Neuzil, MD, PhD,† Srinivas Dukkipati, MD,* Steve Kim, BS,§ Janet Clemens, BS,§ Andre D'Avila, MD*

*From the *Cardiac Arrhythmia Services, Mount Sinai School of Medicine, New York, New York; †Homolka Hospital, Prague, Czech Republic; ‡University of Kentucky, Lexington, Kentucky; and §St. Jude Medical Inc., Minneapolis, Minnesota*



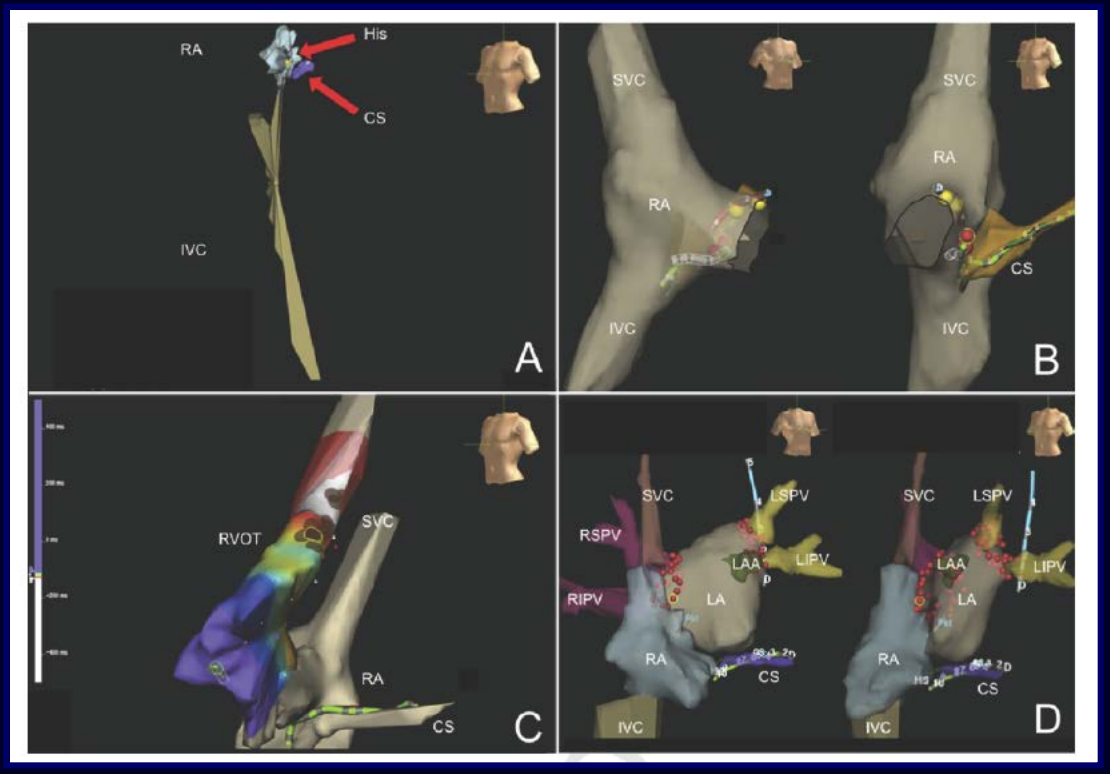


Introduction – Adult Electrophysiology

Contact force–controlled zero-fluoroscopy catheter ablation of right-sided and left atrial arrhythmia substrates

Gunter Kerst, MD,* Hans-Jörg Weig, MD,† Slawomir Weretka, MD,† Peter Seizer, MD,†
Michael Hofbeck, MD,* Meinrad Gawaz, MD,† Jürgen Schreieck, MD†

*From the *Kinderheilkunde II, Pädiatrische Kardiologie and †Medizinische Klinik III, Kardiologie und Kreislauferkrankungen, Eberhard-Karls-Universität Tübingen, Tübingen, Germany.*



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NO-PARTY trial

ClinicalTrials.gov
Protocol Registration System

Send message to PRS

Near Zero Fluoroscopic Exposure During Catheter Ablation of Supraventricular Arrhythmias (NO-PARTY)

This study is currently recruiting participants

Cardiology in the Young 2012; Page 1 of 8
doi:10.1017/S1047951112000042

Original Article

Rationale and design of the NO-PARTY trial: near-zero fluoroscopic exposure during catheter ablation of supraventricular arrhythmias in young patients

Michela Casella,[1] Antonio Dello Russo,[1] Gemma Pelargonio,[2] Maria Grazia Bongiorni,[3] Maurizio Del Greco,[4] Marcello Piacenti,[5] Maria Grazia Andreassi,[5] Pasquale Santangeli,[2] Stefano Bartoletti,[1,6] Massimo Moltrasio,[1] Gaetano Fassini,[1] Massimiliano Marini,[4] Andrea Di Cori,[3] Luigi Di Biase,[7] Cesare Fiorentini,[1,6] Paolo Zecchi,[2] Andrea Natale,[7] Eugenio Picano,[5] Claudio Tondo[1]

[1]*Cardiac Arrhythmia Research Centre, Centro Cardiologico Monzino IRCCS, Milan;* [2]*Department of Cardiovascular Medicine, Catholic University of the Sacred Heart, Rome;* [3]*Department of Cardiovascular Disease 2, Santa Chiara Hospital, Hospital University of Pisa;* [4]*Department of Cardiology, Santa Chiara Hospital, Trento;* [5]*CNR, Institute of Clinical Physiology, Fondazione G. Monasterio, Pisa;* [6]*Department of Cardiovascular Sciences, University of Milan, Milan, Italy;* [7]*Texas Cardiac Arrhythmia Institute, St. Davis Medical Center, Austin, Texas, United States of America*

Centro Cardiologico Monzino

Università Cattolica del Sacro Cuore

Azienda Ospedaliero Universitaria Pisana

IFC CNR

Azienda Ospedaliera di PERUGIA

Provincia Autonoma di Trento
Azienda Provinciale per i Servizi Sanitari

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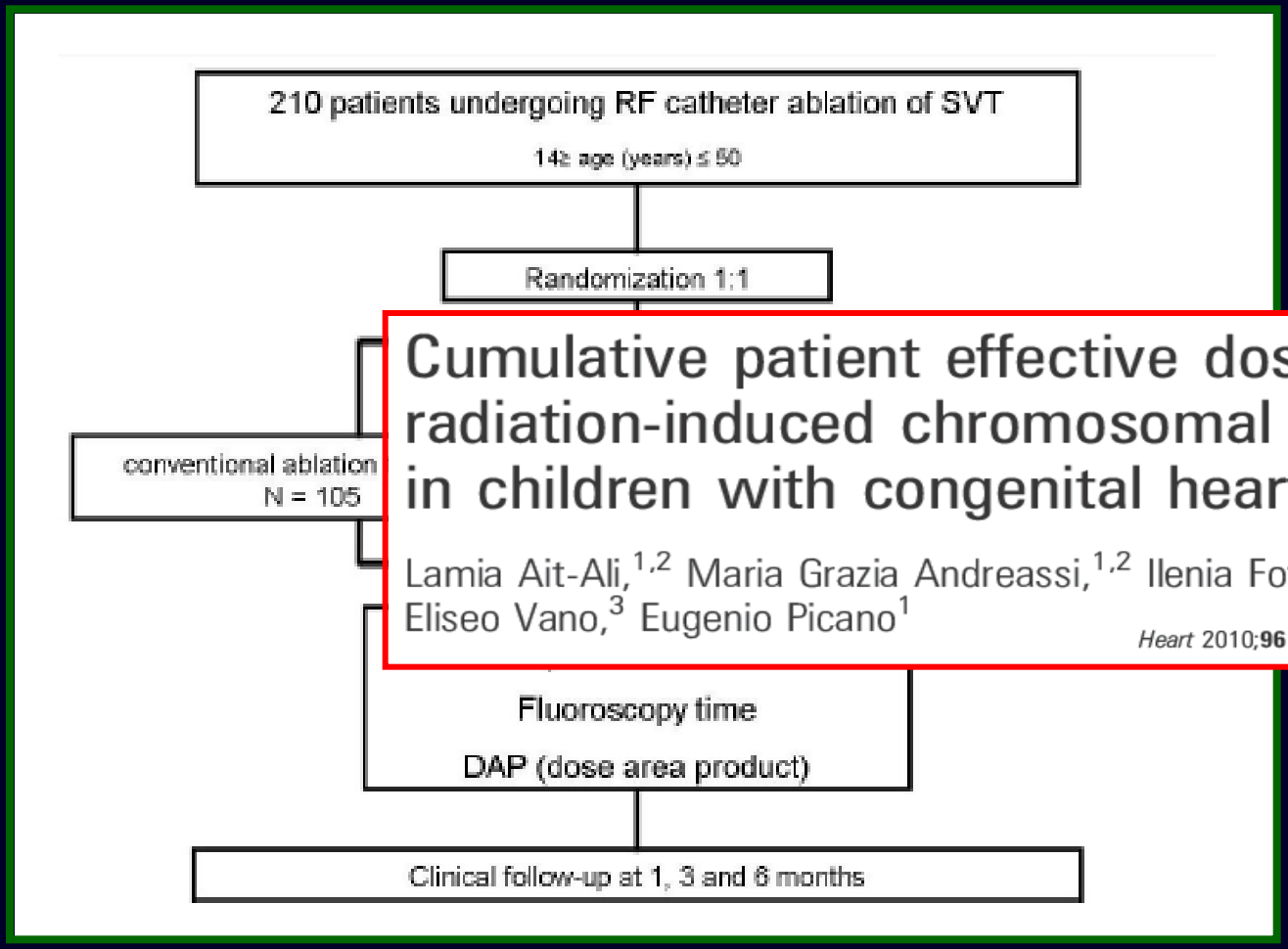
NO-PARTY trial: study design



Chromosomal DNA analysis will be performed in 60 patients

Cumulative patient effective dose and acute radiation-induced chromosomal DNA damage in children with congenital heart disease

Lamia Ait-Ali,[1,2] Maria Grazia Andreassi,[1,2] Ilenia Foffa,[1,2] Isabella Spadoni,[2] Eliseo Vano,[3] Eugenio Picano[1]

Heart 2010;**96**:269—274. doi:10.1136/hrt.2008.160309

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NO-PARTY trial: end-points

Primary end-point

1. reduction in patient exposure to ionizing radiation

Secondary end-points

1. reduction in operator exposure to ionizing radiation
2. reduction in fluoroscopy time
3. cost-effectiveness analysis

NO-PARTY trial: recruitment

145 patients

78 patients
34 males (44%)*
mean age 37 ± 10

66 patients
37 males (56%)*
mean age 34 ± 12

40 (51%)	**AVNRT**	35 (53%)
8 (10%)	**Right APs**	6 (9%)
9 (12%)	**Left APs**	11 (17%)
12 (15%)	**Flutter**	6 (9%)
2 (3%)	**AT**	2 (3%)
7 (9%)	**no RF**	6 (9%)

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Methods - STEP 1

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Methods - STEP 2

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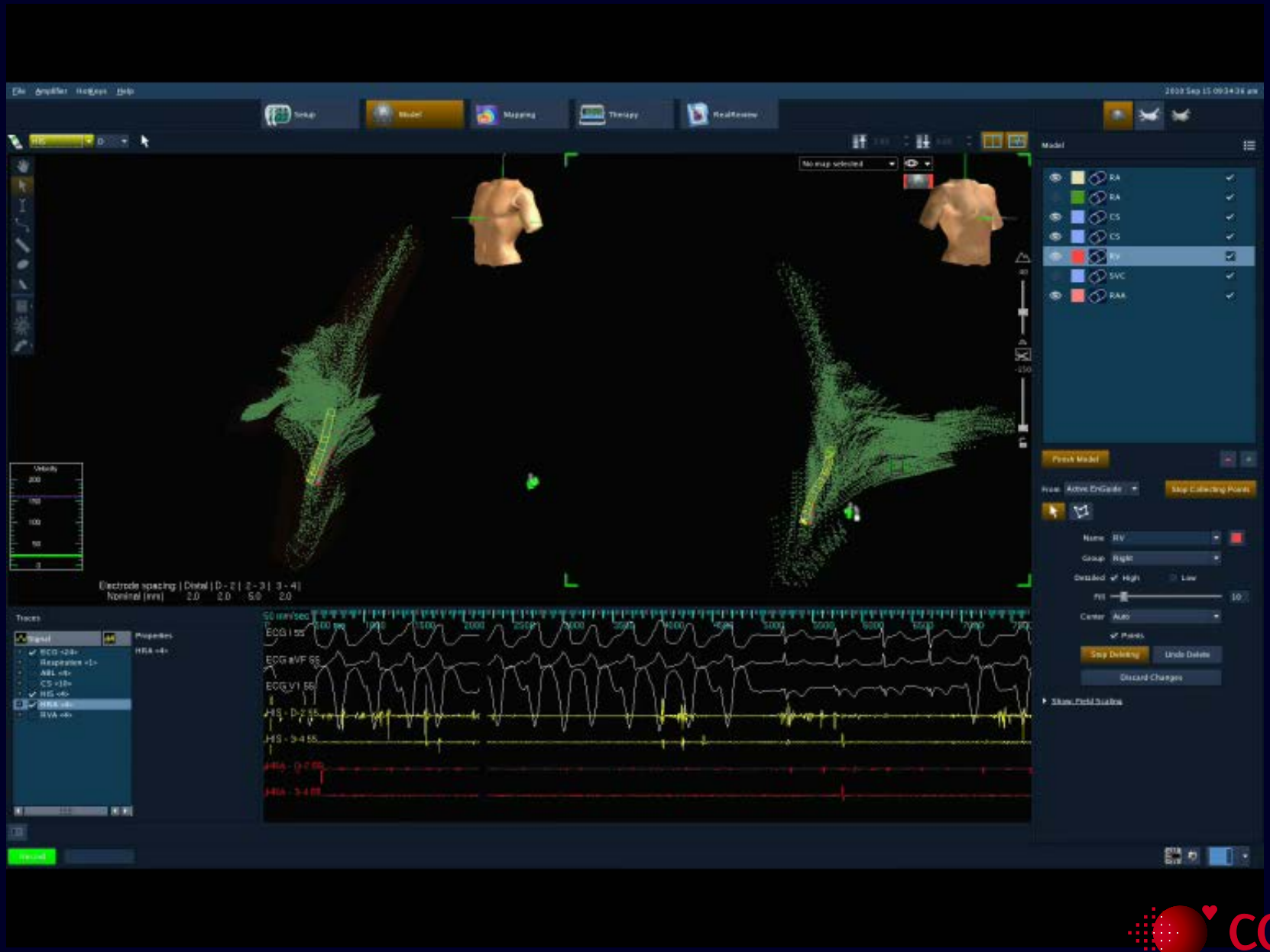
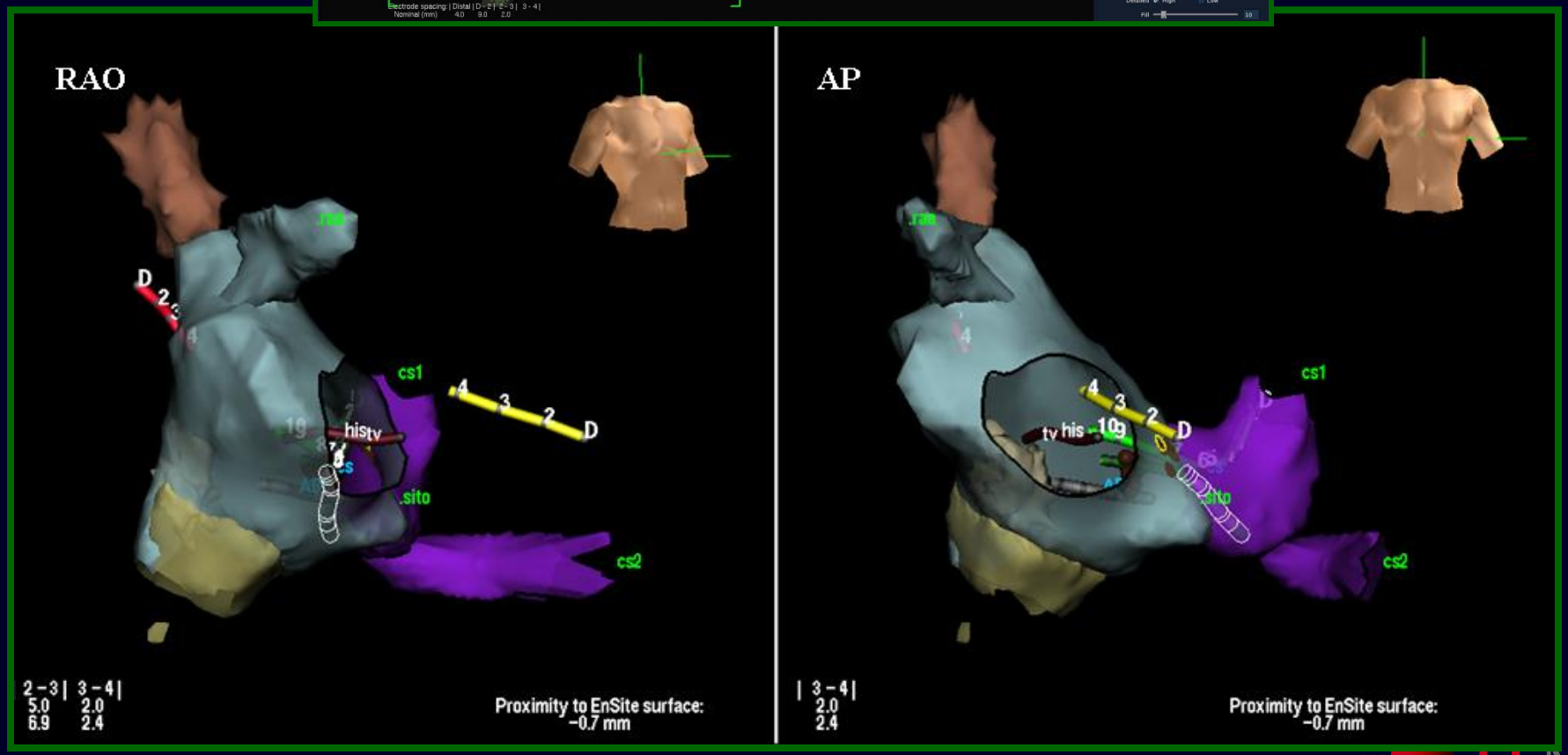
Methods - STEP 3



Methods


Setup
Model
Mapping
Therapy
RealReview
Model
RA
RA
CS
CS
RV
SVC
RAA
Finish Model
Collect Points
Select and Show
Reset
None
Traces
ECG aVF
ECG V1
HIS - D-2
HIS - 3-4
T20- D-2
T20- 3-4
T20- 5-6
T20- 7-8
T20- 9-10
T20- 11-12
T20- 13-14
T20- 15-16
T20- 17-18
T20- 19-20

Methods - STEP 4



AVNRT Ablation

♀ 37 yrs

X-Ray 0”

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postero-midseptal WPW

♂ 14 yrs

X-Ray 39’ 53”

DAP 2738 cGy*cm^2

Dose 5 mSv

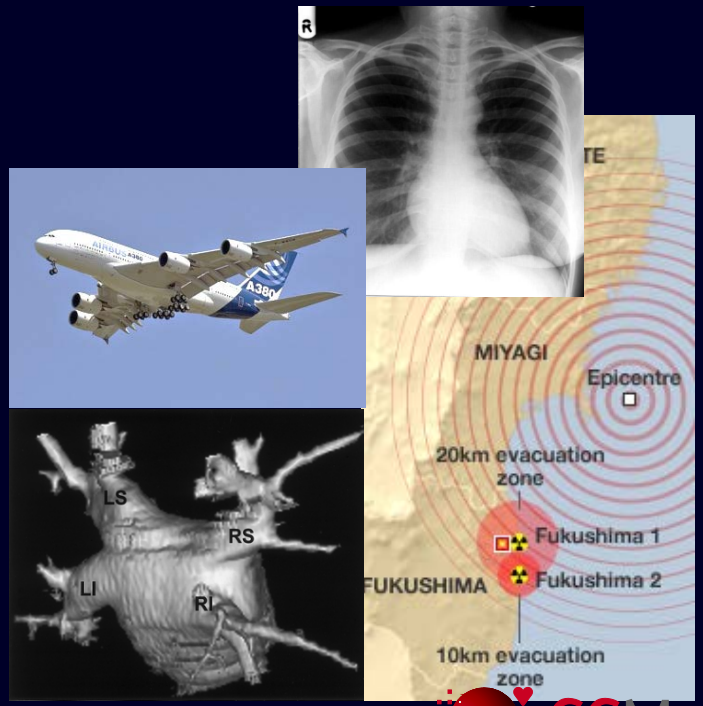
♂ 14 yrs

Dose: 5 mSv

LAR of Cancer Incidence: 6/10000

LAR of Cancer Mortality: 3/10000

1-year natural background radiation	2.5 mSv
Chest x-ray examination	0.02 mSv
Intercontinental flight return trip	0.05 mSv
1 hr within 10 km from Fukushima (March 2011)	0.1 mSv
Coronary angiography	0.4 – 1.5 mSv
Radiofrequency catheter ablation	3.3 - 12 mSv
With additional dose-reduction manoeuvres	1.2 – 2.8 mSv
Cardiac CT angiography	0.8 - 22 mSv



Rogers et al. Heart 2011;97:366-370

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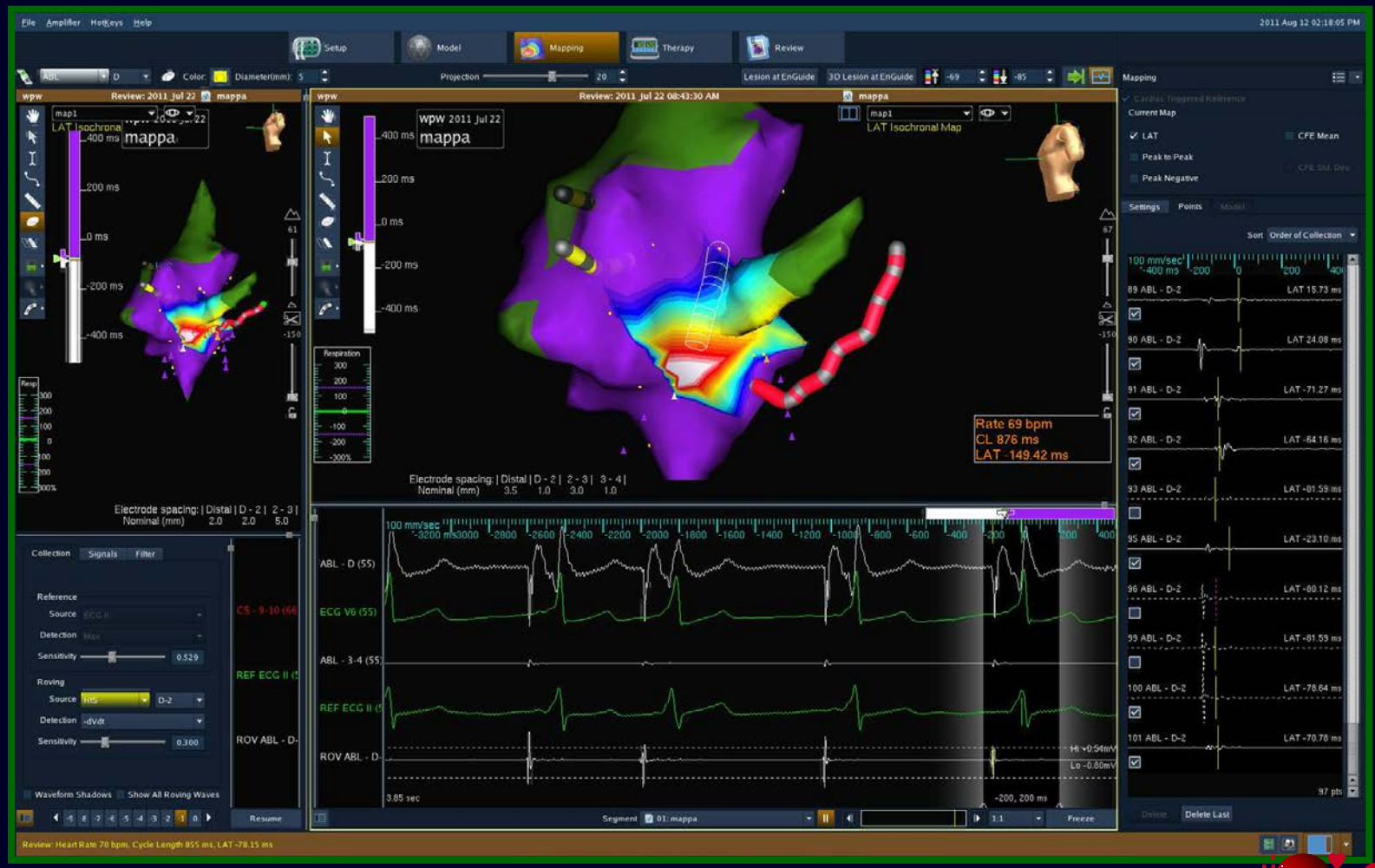
postero-midseptal WPW

II procedure



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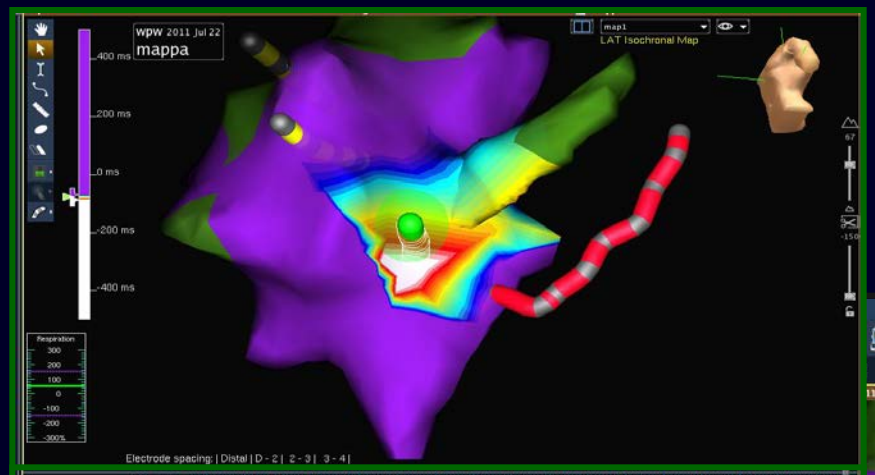
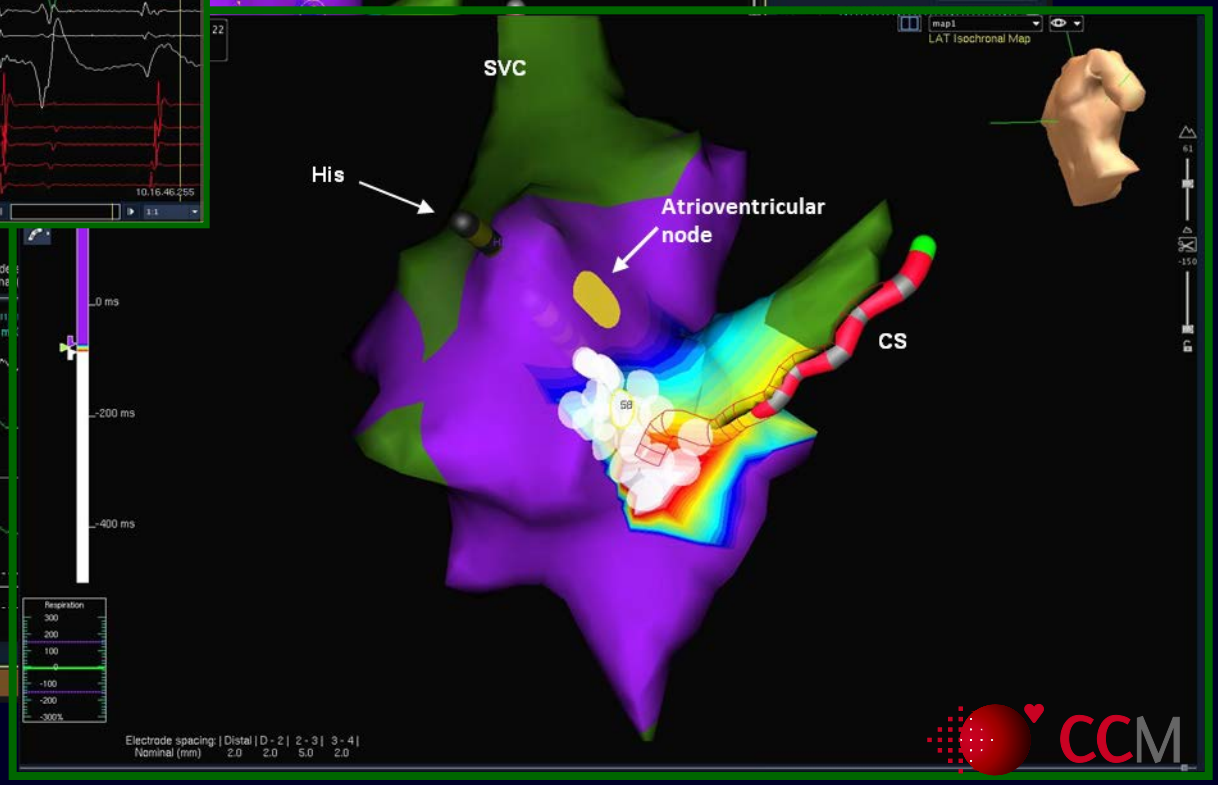
II procedure

X-Ray 0”





Results

N° procedure without fluoroscopy: 59/78 (76%)

	Rx0	Convenzionale	p
Procedural time (min)	100±50	102±49	ns
N° RF pulses	10±9	10±8	ns
RF delivery time (sec)	509±456	498±396	ns
Fluoroscopy time (sec)	50±136	1157±989	<0.0001
DAP (cGy*cm^2)	462±810	8639±13107	<0.0001
Procedural acute success	70/70	60/60	ns

19

Surgeon change	2 (11%)
System failure	1 (5%)
Transeptal punct	4 (21%)
Cath positioning	8 (42%)
Ablation phase	4 (21%)

Rx0	Convenzionale	p
462±810	8639±13107	<0.0001

ΔDAP: 8177 cGy x cm^2

ΔDose: 16 mSv

Thus Spoke BEIR VII

LAR: Lifetime Attributable Risk of Cancer Incidence (‰)		
Età	♂	♀
15	**1.9**	**3.3**
20	**1.6**	**2.6**
30	**1.1**	**1.7**
40	**1.0**	**1.4**
50	**0.9**	**1.2**

In conclusion…

❶ **Non-fluoroscopic SVT catheter ablation can be effectively and safely performed both in the right and left atrium**

❷ **Non-fluoroscopic ablation procedures were comparable to the conventional fluoroscopic approach in terms of procedural acute success, procedural time and RF erogation parameters**

❸ **A cost/effectiveness analysis is necessary to determine the real cost of no-fluoroscopy strategy in order to better identify patients to reccomend this approach**

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"Investire in formazione e informazione sulla sicurezza sul lavoro è un obiettivo di civiltà che dobbiamo al sacrificio di tanti"

(G. Napolitano, 12 Ottobre 2008)

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